ecosystem
MANAGEMENT AND RESTORATION

Technology News from the Ecosystem Management and Restoration Research Program October 1999

Overview of stream restoration technology: State of the science

by J. Craig Fischenich

Interest in restoring ecological, aesthetic, and recreational functions to degraded stream channels has grown enormously in recent years. In 1972, the Council on Environmental Quality estimated that 235,000 miles of streams in the United States had been channelized and more recent estimates suggest that over half of wetland and riparian zones in the coterminous 48 states have been destroyed. Elimination of riparian systems approaches 100 percent in some regions.

The National Research Council has recommended that 400,000 miles of river-riparian ecosystems be restored by the year 2010. Nearly every Federal resource agency manages funding programs targeted at stream restoration and, when combined with state and local funding sources, stream restoration represents a multi-billion-dollar annual industry.

The U.S. Army Corps of Engineers is playing a central role in the stream restoration effort. The 1986 Water Resource Development

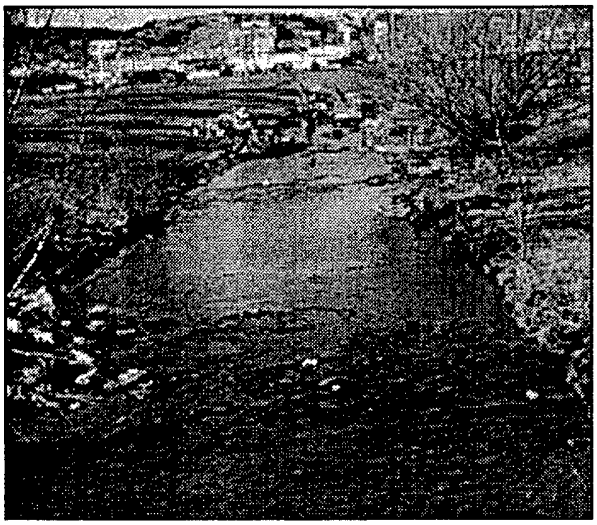


Figure 1. (Before). A flood control and stabilization project that successfully incorporated restoration objectives

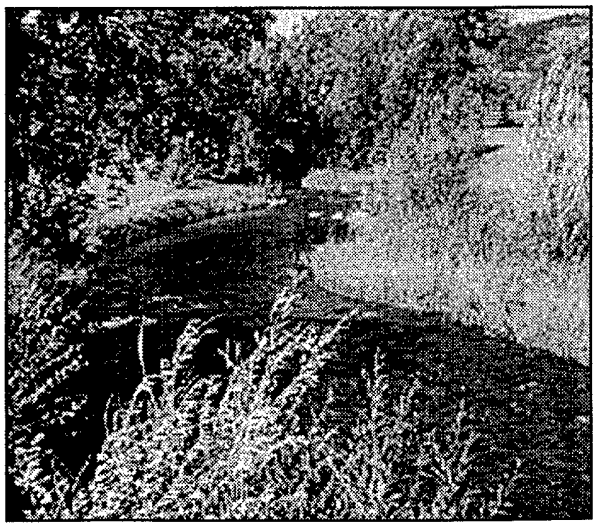


Figure 2. (After). Channel modifications provided relief and generated a 400-percent increase in **Salmonidae** *biomass*

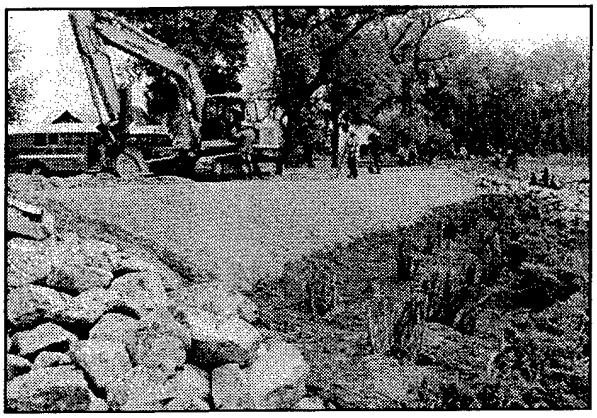
Act and its subsequent amendments provide the Corps with several authorities to undertake restoration efforts and to construct or modify projects for environmental enhancements. The latter, though not technically "restoration," presents the greatest workload and requires application of the same procedures and approaches as restoration. Further, project sponsors are increasingly determined to incorporate environmental enhancements and features into more traditional flood control and navigation projects.

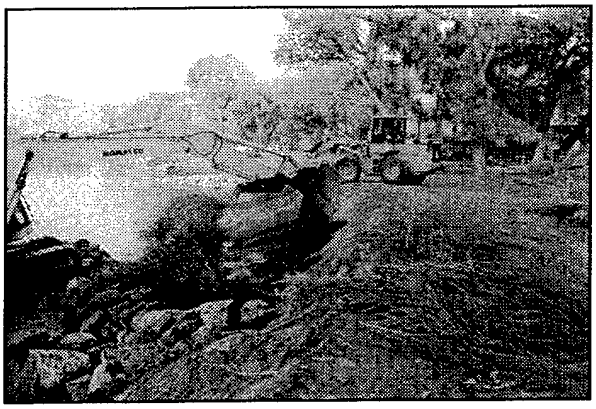
The technology dilemma

The diversity of projects to which the tag "restoration" is applied is staggering and, because of this diversity, a consistent, uniformly applicable restoration procedure has remained elusive. Formulating stream restoration strategies is difficult because of limitations in our ability to characterize ecosystem processes and relationships, and because of diverse and changing social needs.

While much progress has been made in understanding habitat and restoration requirements for specific species, a restoration procedure that treats streams and riparian corridors as functional dynamic ecosystems remains elusive.

With no guidance available, planners and designers must formulate procedures for each project, an extremely difficult task given the multi-objective nature of water resources projects and the physical and ecological complexities of the resources. Adding to these difficulties is the lack of guidance for the appropriate use and integration of recently developed technologies for assessing components of stream and riparian ecosystems.





Streambank protection on Carson River, NV

Program purpose and scope

The Ecosystem Management and Restoration Research Program (EMRRP), established in 1997, provides state-of-the-science techniques for prediction and analysis of environmental impacts of Corps projects and activities. This program's emphasis is on ecosystem restoration that meets broad watershed management objectives.

Objectives of the Stream and Riparian Restoration and Management work unit, a component of the EMRRP, are straightforward: a) formulate, demonstrate, and disseminate guidance for restoring aquatic and riparian ecosystems, and b) develop the analytical and decision support tools needed to assess and restore ecosystems.

While these objectives are simple, meeting them is not. Developing strategies applicable to every circumstance is not possible, so techniques and approaches that address the most common restoration challenges are being targeted. A guidance document that attempts to address all issues associated with restoration would be unwieldy and difficult to compile, so a group of approximately 60 users (individuals with diverse backgrounds that are involved with restoration projects) were asked to formulate a list of needs. Examples of their responses include:

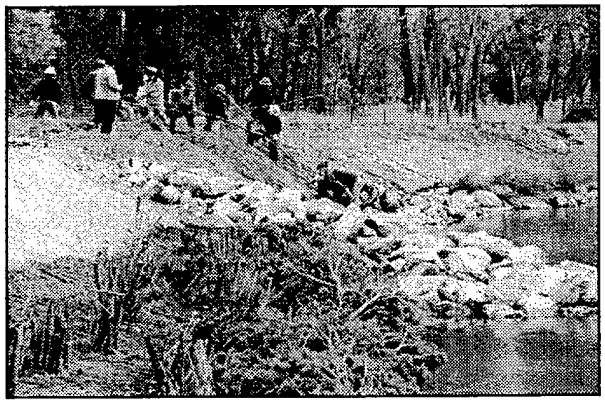
- ✦ What equations should be used to size rock for instream boulders, or wing deflectors?
- ✦ What are the minimum requirements for buffer zone widths?
- ✦ Can we summarize requirements and population dynamics for targeted fish and wildlife species?
- ✦ What are the monitoring and maintenance requirements for vegetation used in restoration projects?

Terrestrial habitat

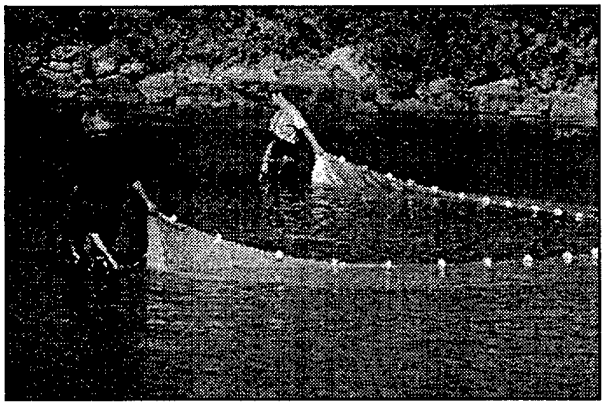
Technology transfer

The needs listed above are being addressed in technical notes that focus on these and other specific questions. The technical notes are brief "how-to" documents that address a specific need identified in the oversight committee's questions.

While the technical notes are written for the Corps community, they are also directed at a broad audience that includes professionals at the state level and local sponsors of Corps projects. These technical notes will be posted on the WES Web site at *www.wes.army.mil/el/emrrrp*



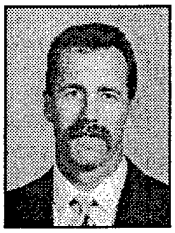
Volunteers installing bioengineering features on a restoration project near Carson, NV



Aquatic habitat

While the how-to technical notes just described solve many problems, they do not address another challenge—how do we integrate the diverse knowledge needed to transition from site- or species-specific restoration to ecosystem-based restoration? The EMRRP has been organized to foster the conduct of research that not only meets immediate specific needs but also can be combined with other technologies to address much broader issues.

About the Author:



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New Publications

Listed below are technical notes completed or under development in the stream restoration Technical Note series available on the World Wide Web at *http://www.wes.army.mil/el/emrrp*

TN EMRRP-SR-01 . . Glossary of Stream Restoration Terms
TN EMRRP-SR-02 . . Stream Restoration - Principles and Practices
TN EMRRP-SR-03 . . Preliminary Watershed Assessment
TN EMRRP-SR-04 . . Coir Geotechnical Roll and Wetland Plants for Streambank Erosion Control
TN EMRRP-SR-05 . . Computing Scour
TN EMRRP-SR-06 . . Habitat Requirements for Freshwater Fishes
TN EMRRP-SR-07 . . Resistance Due to Vegetation
TN EMRRP-SR-08 . . Determining Drag Coefficients and Area for Vegetation
TN EMRRP-SR-09 . . Reconnection of Floodplains with Incised Channels
TN EMRRP-SR-10 . . Robert B. Manning – An Historical Perspective
TN EMRRP-SR-11 . . Boulder Clusters
TN EMRRP-SR-12 . . Irrigation Systems for Riparian Vegetation
TN EMRRP-SR-13 . . Streambank Habitat Enhancement with Large Woody Debris
TN EMRRP-SR-14 . . Acid Mine Drainage Treatment
TN EMRRP-SR-15 . . A Function Basis for Stream Restoration
TN EMRRP-SR-16 . . Low Head Stone Weirs
TN EMRRP-SR-17 . . Ecological Value and Impacts of Riprap
TN EMRRP-SR-18 . . The Use of Regime Relations for Stream Restoration Design
TN EMRRP-SR-19 . . Design of Low-Flow Channels
TN EMRRP-SR-20 . . Environmental Tolerances of Vegetation Used for Restoration Projects

New Publications (Continued)

TN EMRRP-SR- . . . Pruning Guidelines for Riparian Restoration Projects
TN EMRRP-SR- . . . Flow Resistance for Vegetated Channels and Floodplains
TN EMRRP-SR- . . . Hydraulic and Hydrologic Analyses for Bioengineering Projects
TN EMRRP-SR- . . . Stable Channel Design Procedures for Restoration Projects
TN EMRRP-SR- . . . Hydrologic Impacts of Urbanization on Base and Peak Flows
TN EMRRP-SR- . . . Heavy Equipment Used in Stream Restoration
TN EMRRP-SR- . . . Classification for Stream Restoration
TN EMRRP-SR- . . . Fish Index of Similar Habitat (FISH)
TN EMRRP-SR- . . . Brush Mattress and Wattling for Streambank Erosion Control
TN EMRRP-SR- . . . Branchbox Breakwater and Wetland Plants for Riparian Shoreline Restoration
TN EMRRP-SR- . . . Anthropogenic Causes and Controls of Stream Evolution
TN EMRRP-SR- . . . Design and Construction of Rootwad Structures

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http://www.wes.army.mil/el/emrrp

Ecosystem Management and Restoration Research Program

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